ATTACHMENT I

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Metal Fixing Material Bushing and Method for Producing a Base Plate of a Metal Fixing Material Bushing

Background of the Invention

[0001] The invention relates to a metal fixing material bushing.

[0002] Metal fixing material bushings are in the state of the art in various designs. By metal fixing material bushings, vacuum-tight sealings of fixing materials are understood, in particular sealings of glasses to metals. The metals act as electric conductors. As representatives, reference is made to U.S. Patents Nos. 5,345,872 and 3,274,937. Such bushings are common in electronics and in electrical engineering. The glass used for sealing serves as an insulator. Typical metal fixing material bushings are built in such a way, that metallic inner conductors are sealed in a preformed sintered glass part, whereby the sintered glass part or the glass tube in an outer metal part is sealed with the so-called base plate. For example, igniters are preferred applications of such metal fixing material bushings. Said igniters are used among other things for airbags or belt tensioning pulleys in motor vehicles. In this case the metal fixing material bushings are components of an ignition device. In addition to the metal fixing material bushing, the entire ignition device comprises a spark gap, the explosive metal cover, which tightly encapsulates the ignition mechanism. Either one or two or more than two metallic pins can be passed through the bushing. In a preferred implementation with one metallic pin the casing is grounded, in a preferred two-pole embodiment it grounded to one of the pins. The previously described ignition device is used in particular for air bags or belt tensioning pulleys in motor vehicles. Known devices of the named or similar type are described in US 6 274 252, US 5 621 183, DE 29 04 174 A1 or DE 199 27 233 A1, whose disclosure content is fully included in the present application. The previously named ignition units have two metal pins. However, electronic ignition devices are also possible with only a single pin. The ignition devices shown in the state of the art comprise a metal base plate, for example a metal sleeve, which is constructed as a swivel part. The metal base plate exhibits at least

one opening through which at least one metal pin is passed. One significant problem of this design consists in the fact that such a design is both material and cost-intensive.

[0003] The invention is therefore based on the object of creating a metal fixing material bushing of the initially named type in such a way that it is characterized by a high strength with low material and labor expenses and by a suitability for higher stresses and further that assembly errors, which result from the inaccurate correspondence of the individual elements, are avoided.

Summary of the Invention

[0004] The invention's solution is characterized by the features of the independent claim.

[0005] The metal fixing material bushing comprises a metal base plate, through which at least one metal pin is passed. If two metal pins are provided in a preferred embodiment, one of the two pins at least directly or indirectly via additional elements establishes the ground connection to the base plate. In the implementation with two metal pins these metal pins are preferably arranged parallel to one another. At least one of the metal pins is arranged in a opening in the base body and fixed across from said base body by means of fixing material, preferably in the form of a glass plug. As per the invention the base plate is formed by a sheet metal element, whereby in a first embodiment at least the opening is produced by means of a separation process, in particular punching. The base plate itself is preferably also punched out of a solid material, the final geometry of the base plate however is retained by means of a forming process for example deep drawing. In a preferred embodiment the final geometry describing the exterior contour and the base geometry describing the opening is produced at least by means of one separation process, in particular punching. Final geometry means that no more forming processes have to be performed on it. Base geometry means that it either represents the final geometry in the case of no further necessary changes or that changes can still be undertaken to said base geometry by means of further manufacturing methods, in particular forming methods, whereby the final geometry is not achieved until after these additional methods. Retention structures are provided between the front and the rear for avoiding a relative motion of fixing material in the direction of the rear toward the inner circumference of the. The structures are integrable components of the base plate or form together with the base plate a structural unit.

[0006] The production of the geometry by means of a separation process means that the final geometry on the outer circumference of the base plate is produced by means of blanking and the geometry of the opening is produced by means of punching. The structures for avoiding a relative motion of fixing material in the direction of the rear toward the inner circumference of the opening are provided for the purpose of getting control of the difficulties resulting from the sealing of the single metal pin in a opening and also for the purpose of security against a withdrawal of the unit fixing material and metal pin. Said retention structures act as a kind of barb and lead in the case of relative motion in the direction of the rear to a positive locking between fixing material plugs, in particular glass plug and base plate. These comprise for example at least one local contraction in the opening, whereby they can be provided in the entire region of the inner circumference, except for the front of the base plate.

[0007] The solution of the invention makes it possible to resort to a more cost-effective manufacturing method and starting materials, whereby the inventory is considerably minimized. Additionally, the entire base plate can be designed as an integral component, into which the metal pin is sealed by means of fixing material. Another significant advantage consists in the fact that even under increased loads on the single metal pin, for example a pressure load, a pressing out of the metal pin with the glass plug from the port opening is safely prevented. The overall design also builds smaller in width and is also applicable at a slighter size through the guarantee of the secure fixing of the metal pin in the base plate, even with higher loads.

[0008] Critical in the process is the fact that the local contraction of the cross section in the region of the rear or between the rear and front occur, whereby however the front is always characterized by a greater diameter.

[0009] In accordance with an especially advantageous design the second metal pin is grounded or fastened to ground as a ground pin on the rear of the base plate. As a result of this, additional measures for grounding a metal pin fixed in the base plate with fixing material or electrically coupling it to the base plate are no longer needed. Further, there is still only one pin to be fixed in a opening, whereby the possibilities for securely fixing the single pin completely in circumferential direction become more varied and the potential connecting surface for the ground pin can be enlarged.

[0010] For example a glass plug, a ceramic plug, a glass-ceramic plug or a high-performance polymer can be used as fixing material.

[0011] A number of possibilities exist for the concrete development of the resources for prevention of a relative motion between the fixing material and opening, in particular slipping out. These are characterized by measures on the base plate. In the simplest case measures on the base plate are resorted to, which can be implemented in production, particularly during the punching process. In the process the opening between the rear and the front is characterized by a change of the cross-sectional contour. In the simplest case at least two areas of variable inside dimensions are provided in the design as opening with circular cross section with variable diameter. In the process the cross-sectional change can take place in stages or continuously. In the latter case the opening between the front and rear is tapered in design, whereby said opening narrows to the rear. The measures on the base plate are as a rule further characterized by the provision of several recesses or projections. These form at least one undercut arranged between the rear and the front viewed on the inner circumference of the opening in the base plate, whereby the front is free of such undercuts. In the symmetrical construction of the opening this is characterized by three sub-areas – a first sub-area, which extends from the rear in the direction of the front, a second sub-area connected to the first one and a third sub-area, which extends from the front in the direction of the rear. The second sub-area is characterized by slighter or greater dimensions of the opening than the first and third sub-areas. Preferably the first and second sub-areas are then characterized by identical cross-sectional dimensions.

[0012] In implementations with more than two areas of variable dimensions, in particular with variable diameters methods are selected which result from machining both sides of the base plate. If in the previously described implementations an asymmetrical shape of the opening is intended, with these implementations with more than two areas preferably a development of the opening is selected which can be used in any way with regard to the mounting position. This is, relative to a theoretical center line which runs vertically to the pin axis of the pin in the base plate and which extends in the central area of the base plate, symmetrically designed. Therewith the front and the rear can, with regard to their function, also be exchanged. The undercuts formed by these counteract possible movements of the fixing material plug in both directions.

[0013] In accordance with a further design there can also be a multiple number of projections arranged in circumferential direction distanced to each other on a common length between the front and the rear. These are as a rule produced by stamping, i.e. local forming under pressure in the area of the rear. The manufacturing process is thus especially cost-effective.

[0014] Another option for prevention of relative motions between fixing material plug and port consists in the forming of a positive connection between them. For example, normally the glass is placed in the opening together with the metal pin, the glass and metal ring are heated up, so that after the cooling the metal heat shrinks onto the glass plug. In general the opening exhibits in essence the final diameter after the punching of the opening. Naturally the punched opening can itself be machined, for example polished without the final diameter changing significantly. The opening can have a circular cross section. Other possibilities are conceivable, for example an oval cross section.

[0015] In accordance with an advantageous further development for additional prevention of relative motions under load between metal pin and fixing material measures on the metal pin are provided. In this process this can be a matter of projections or recesses extending over the entire outer circumference of the metal pin or with random or fixed predefined projections arranged next to each other in circumferential direction.

[0016] The method for manufacturing a base plate of a metal bushing is characterized by the fact that the end contour describing the outer geometry is gained by means of a separation process free of machining from a sheet metal part of predefined thickness. The achievement of the base geometry describing the form of the opening for formation of the opening also occurs for at least one metal pin by means of punching out of the sheet metal part. In the process both operations can be in cost-saving fashion in a single tool and one processing step. The undercuts in the openings are developed by means of deformation of the openings, for example by means of stamping. The single stamping operation can be undertaken before or after the punching operation. Preferably the stamping and punching operation take place on the same side of the base plate, to avoid unnecessary workpiece position changes and perhaps have these processes run one immediately after the other.

[0017] Corresponding to the desired geometries to be attained the stamping operations occur either on one side or both sides, whereby in the latter case preferably identical

stamping parameters are set, in order to ensure a symmetrical implementation of the opening.

Brief Description of the Drawings

[0018] The invention's solution is explained in detail in the following using figures. The figures show the following:

[0019] Figure 1a illustrates a first embodiment of a metal fixing material bushing designed as per the invention;

[0020] Figures 1b through 1e illustrate in greatly simplified diagrammatic view the basic principle of a method as per the invention for manufacturing a base plate in accordance with the invention;

[0021] Figure 2a illustrates a second embodiment of a metal fixing material bushing designed as per the invention with tapered design of the opening;

[0022] Figures 2b through 2c illustrate a further embodiment of the method as per the invention for manufacturing a base plate in accordance with Figure 2a after a punching operation;

[0023] Figure 3 illustrates a third embodiment of a metal fixing material bushing designed as per the invention with partially tapered design of the opening;

[0024] Figure 4 illustrates an embodiment of the metal fixing material bushing designed as per the invention with a projection between the front and rear in the contour describing the opening;

[0025] Figure 5 illustrates an embodiment of the metal fixing material bushing designed as per the invention with a recess between the front and rear in the contour describing the opening;

[0026] Figure 6 illustrates an implementation as per Figure 1a with additional projections on the metal pin;

[0027] Figure 7 illustrates a further development as per Figure 6;

[0028] Figure 8 illustrates a further embodiment of the metal fixing material bushing designed as per the invention with punctual contraction of the cross section in the region of the rear;

[0029] Figure 9 illustrates an embodiment of the metal fixing material bushing designed as per the invention with surface texturing in the opening;

[0030] Figure 10 illustrates a further alternative embodiment of the metal fixing material bushing designed as per the invention;

[0031] Figure 11 illustrates an embodiment with a metal pin, a so-called mono-pin.

Detailed Description

[0032] Figure 1a illustrates a first implementation of a metal fixing material bushing 1 designed as per the invention using an axial section, for example for use as an igniter of an airbag. This comprises a base plate 3 forming a metal collar, with which two parallel metal pins 4 and 5 are electrically coupled. The two metal pins 4 and 5 are arranged parallel to one another. In the process one acts as a conductor, while the second pin is grounded. In the represented case the first metal pin 4 acts as a conductor and metal pin 5 acts as the ground pin. At least one of the metal pins, in particular the metal pin 4 acting as the conductor is guided through the base plate 3. In the represented case the ground pin 5 is directly attached to the rear 12 of the base plate 3. The metal pin 4 is for this purpose sealed on a part l_1 of its length l in fixing material such as a glass plug 6 cooled from molten glass. The metal pin 4 protrudes at least on one side over the face 7 of the glass plug 6 and in the represented embodiment seals flush with the second face 8 of the glass plug 6. Other variants are also conceivable. Preferably not only the opening, but also the base plate 3 is designed as a punched element. This means that the geometry describing the outer contour, in particular the outer circumference 10 is produced by means of blanking, preferably punching. The punch part can either continue to be used in the geometry as it is present after the punching operation or can be deformed in a further operation, for example it can be deep drawn. The opening 11 provided receiving and fixing of the metal pin 4 by means of the glass plug 6 is produced in a preferred embodiment by means of a punching operation in the form of slotting. Subsequently the metal pin 4 is inserted at the rear 12 of the metal fixing material bushing 1 together with the glass plug into the opening 11 and the metal plate containing the glass plug and the metal pin is heated, so that after a cooling operation the metal heat shrinks and in this way a non-positive connection between glass plug 6 with metal pin 4 and base plate 3 is formed. It is also conceivable to insert the fixing material in molten or fluid state, in particular the molten glass from the front side 13 into the opening 11. During the cooling a positive and material connection incorporated into the material comes into being both between the outer circumference 14 of the metal pin 4 as well as between the inner

circumference 15 of the opening 11. To prevent a loosening of the metal pin 4 with the glass plug 6 from the base plate 3 in the case of stress of the entire metal fixing material bushing 1 during ignition, retention structures can be provided for prevention of a relative motion between fixing material 6 and inner circumference 15 of the opening in the direction of the rear side 12. These act sort of as a barb and bring about a positive locking between base plate 3 and glass plug 6 under tensile force influence and/or pressure on the glass plug 6 and/or the metal pin 4 and prevent therewith a slipping out at the rear 12. For this purpose as per a first embodiment the opening 11 is designed in such a way that it has an undercut 36, which is formed by a projection 37. This projection is arranged in the region of the rear 12 and in the represented case closes flush with it. The opening 11, which in the represented case is preferably designed with a circular cross section, is characterized through this projection 37 by means of two different diameters d_1 and d_2. Diameter d_1 is greater than diameter d_2. Diameter d_2 is the diameter of the opening 11 at the rear 12. Diameter d_1 is the diameter of the opening 11 at the front 13. Thereby the opening 11 is executed over a significant part of its extent l_{d1} with the same diameter d_1. l_{d2} stands for the design of opening 11 with diameter d_2. That is, the opening has two sub-areas, a first sub-area 16 and a second sub-area 17, whereby the first sub-area 16 is characterized by diameter d_1 and the second sub-area 17 is characterized by diameter d_2. These diameters are produced thereby by means of a single-sided stamping operation in the form of slotting of the sides of the front 13 or rear 12 with subsequent deformation operation under the influence of pressure, particularly stamping, as represented in Figures 1b through 1c on base plate 3. Preferably the punching and deformation operation each occur from the same side, in the represented case from the front 13. The blanking of base plate 3 can also take place within the framework of a punching operation or a preceding cutting operation, for example water-jet cutting or laser-beam cutting. Preferably this takes place however by means of punching. The tool for this is designed in such a way that the entire base plate 3 with a opening 11 is punched out in one processing step out of sheet metal 38 of a specified sheet thickness b, which corresponds to a thickness D of base plate 3.

[0033] Figures 1b through 1e illustrates in diagrammatically simplified representation the basic principle of the invention’s method for manufacturing of a base plate 3 with the required geometry. Figure 1b illustrates in diagrammatically simplified representation the

design of the punching tool out of two sub-tools, one bottom part in the form of a die 40 and one upper part in the form of a punch 41. In the process the punch 41 moves toward the sheet metal 38 lying on a matrix. The feed direction is designated by an arrow. The base plate 3' resulting from this with regard to its outer final geometry and the geometry of the opening 11' after the punching is reproduced in Figure 1c. The base plate 3' can in this state and this position undergo a further stamping operation, in order to achieve the geometry of the opening 11' shown in Figure 1a, I particular the undercut 36 formed by the projection 37. The stamping tool 42 is allocated to the front 23 of the base plate 3' and is active on the opening 11', as present after the punching, from the side of the front 12 in the direction of the rear 12. The active depth t_1, which in the final state of the base plate 3 characterizes the distance of the undercut 36 from the front 13 is guaranteed in the process by means of the form of the stamping tool 42 and the stamp depth conditioned by it or else only through the stamp depth. Figure 1e illustrates the position of the stamping tool 42 toward the base plate 3' in the final state, i.e. after successful stamping, whereby in this state the base plate 3' corresponds to the base plate 3. The finishing metals characterize the state of the element to be machined during production. In order to achieve an optimum stamping result, metallic materials with good flowability in the selected pressure impact are used as sheet metals 38 or thin elements. Preferably CuNi alloys or Al alloys or Ni or Fe alloys are used as metals. The use of steels, for example stainless steel, CRS 1010 , constructional steels or Cr-Ni steel is particularly preferable.

[0034] In the implementation shown in Figures 1a through 1e the opening 11 has a circular cross section. However, other forms are also conceivable, whereby in this case an undercut is formed by means of changing the inner dimensions of the opening. Further the displayed geometries are reproduced idealized. For example, in practice, as a rule surface areas that are not completely at right angles to each other will develop. It is crucial that a base contour of the opening be created, which for one does justice to the reception of a sealed metal pin and further the prevention of an outward movement of the totality of metal pin and fixing material, in particular the glass plug, i.e. also the surface areas forming the undercut and the adjacent surface areas can be arranged at an angle to each other.

[0035] Figure 2a illustrates a further design of the base plate 3.2 using an axial cut through a metal fixing material bushing 1.2. The base structure of the metal fixing

material bushing 1.2 corresponds to the one described in Figure 1, for which reasons the same reference symbols are used for the same elements but with a suffix corresponding to the figure number. In the implementation as per Figure 2a the opening 11.2 is however has a tapered design. In the process the diameter proceeding from the front 13.2 to the rear 12.3 decreases steadily. This steady decrease in diameter by means of the formation of a cone embodies the resource for the prevention of a relative motion between the fixing material and the inner circumference of the opening.

[0036] Figure 2b illustrates the base plate 3.2' resulting after the punching operation after stamping. An opening 11.2' can be seen with equal dimensions throughout. Figure 2c illustrates the stamping tool 43, which has a tapered design and acts on the base plate 3.2' as per Figure 2b from the front 13.2 against a die 44. In contrast to this, Figure 3 discloses a combination of the implementation according to Figures 1 and 2, in which only a part of the opening 11.3 has a tapered design. In this implementation the opening 11.3 of the metal fixing material bushing 1.3, particularly in base plate 3.3 is also divided into two sections, a first sub-area 16.3 and a second sub-area 17.3. The second sub-area 17.3 is characterized by a constant diameter $d_{2.3}$ over its length $l_{d2.3}$. The second sub-area 17.3 extends from the rear 12.3 toward the front 13.3 The first sub-area 16.3 is characterized by a constant cross section reduction of the opening 11.3. The reduction takes place from a diameter d1.3 up to a diameter d2.3. The low diameters at the rears 12.2, 12.3 as per the implementations of Figures 2 and 3 offer the advantage of a greater connecting surface 18 for metal pin 5.2 or 5.3, in particular for the ground pin. The undercut 36.3 results on the basis of the diameter change viewed from the second to the first sub-area 16.3.

[0037] In all of the embodiments shown in Figures 1 through 3 the asymmetrical geometry of the opening 11, when considered from the front 13 to the rear 12, offers the advantage of prevention of a slipping or pulling out of the glass plug 6 at the rear 12 or in the direction of the rear. Additionally, during the assembly as a result of the asymmetrical geometry there can be an easier orientation for the mounting position of the individual elements, in particular the metal pins 4 and 5. On the basis of the undercut a loosening of the constructional unit from metal pin 4 and the glass plug 6 from the base plate during ignition can be avoided. The additional material at the rear 12 offers the advantage of a

greater connecting surface for the metal pin 5.3 to be grounded. Further this increases the strength of the glass seal of the metal pin in case of pressure impact on the front.

[0038] Figures 4 and 5 illustrate two further implementations of a metal fixing material bushing 1.4 and 1.5 as per the invention with opening 11.4 and 11.5. With these implementations the opening 11 can be subdivided into three sub-areas. In the case of the implementation as per Figure 4 in the sub-areas 20, 21, 22, whereby the first and third sub-areas 20 and 22 are preferably characterized by the same diameter d_{20} and d_{22}. The second sub-area 21 is characterized by a lesser diameter d_{21} than diameters d_{20} and d_{22} and forms therewith a projection 23. Said projection forms the undercut 36.4 arranged between the front and rear for prevention of relative motion of the glass plug 6.4 in the direction of the rear 12.4 towards the inner circumference 15.4 of the opening 11.4. In particular the surfaces 24 and 25 directed toward the front 13.4 and rear 12.4 form the stop faces for the glass plug 6.4 in axial direction. This implementation is characterized by a fixing of the glass plug 6.4 in both directions, so that this development is suitable in particularly advantageous fashion for being randomly incorporable and positionable, particularly with regard to the connection of the metal pins 4.4.

[0039] This also holds true in analogy for the development of the metal fixing material bushing 1.5 presented in Figure 5, in particular of the base plate 3.5. This development can also be subdivided into at least three sub-areas, whereby these individual sub-areas, which are marked here as 20.5, 21.5 and 22.5, describe a recess 26, which is arranged between the rear and front 12.5 and 13.5 respectively. The two outer sub-areas – first sub-area 20.5 and third sub-area 22.5 – form in the process projections 27 and 28. The surfaces 29 and 30 of the individual projections 27 and 28 pointing at each other in the process form a stop for the cooled glass plug 6.5 in shifting between rear 12.5 and front 13.5. Both implementations cause an increase of the required hydrostatic forces in order to set the glass plug 6 in motion under shearing of parts of them in the case of pressure load.

[0040] With all of the solutions described up to now it is possible to use a narrower base plate 3 in comparison to the known solutions from the state of the art with equal or increased strength of the seal caused by the glass plug 6.

[0041] The production of the base plate 3.4 as per Figure 4 occurs by means of punching of the base plate 3.4 with a opening 11.4 with constant diameter. The projection

is achieved by means of two-sided stamping with a predefined stamp depth and a stamping tool with a greater diameter than the existing diameter of the opening after the punching. On the basis of the increase of the surface tension of the material on the base plate under the influence of the stamping tool in the case of the exceeding of the flow limit a flow of the material occurs, which then forms the projection 23. In the process it is irrelevant whether the stamping operation takes place first from the front or rear of the base plate.

[0042] In case a symmetrical design is desired, the stamping forces and the stamp depth should however be selected equally for both sides. The effected implementations apply in analogy also for the formation of the base plate as per Figure 5. Here, too in the first processing step a punching out of the outer geometry of the base plate 3.5 with opening 11.5 occurs. The two projections 27 and 28 in the area of the front and rear 12 and 13 are then formed by means of the pressure forces becoming active on the front and rears 12.5, 13.5 on the base plate 3.5. In the process the represented form of the recess is idealized.

[0043] If Figures 4 and 5 illustrate measures on the base plate 3.4 or 3.5, in particular the openings 11.4 and 11.5 for prevention of a relative motion of the glass plug 6 toward them, Figures 6 and 7 show measures on the metal pin 4.6 or 4.7 which serve to prevent movement of the of the metal pin 4.6 or 4.7 out of the glass plug 6.6 or 6.7 during the test and further during the ignition operation. Figure 6 represents a combination of the implementation presented in Figure 1 with additional modification of the metal pin 4.6. The pin 4.6 has at least one projection in the coupling area with base plate 3.6, said projection is marked 31 and extends in circumferential direction around the outer circumference 32 of the pin 4.6. In the presented implementation it is a matter of a projection 31, which extends around the entire outer circumference 32 of the metal pin 4.6. This projection can be formed by means of compressing or squeezing of the metal pin 4.6. Another possibility not shown here contains the arrangement of several projections adjacent to each other in circumferential direction, preferably arranged adjacent to each other at an equal distance on the metal pin 4.6 in the area of the coupling n the base plate 3.6. The feature of projections on the metal pin 4.6 contributes considerably to the improvement of the strength of the connection. This feature prevents the removal of the metal pin 4.6 during a corresponding test, in which normally the metal

pin fails with tensile stress and removal of the glass plug. This holds true in analogy for the development as per Figure 7. With this development, the metal pin 4.7 has in the contact area with the molten glass a number of projections arranged from above the axial extent of the opening, which are connected in series. In the simplest case a fluting 33 is used. With this fluting the same effect can be achieved as described in Figure 6. The remaining structure matches that described in Figure 6, which is why the same reference symbols are used for the same elements.

[0044] The implementations described in Figures 6 and 7 can additionally also be combined with the measures presented in Figures 2 through 5 on the base plate, in particular the openings.

[0045] Figure 8 shows a development in which the opening 11.8 is with the same diameter over the entire extent between rear 12 and front 13, whereby in the area of the rear 12.8 the base plate 3.8 is exposed to a stamping process. This takes place by means of pressurization on the rear 12.8, whereby this pressurization is performed punctually in the area of the circumference of the opening 11.8. The pressure impact follows the pressure execution on the rear 12.8. As a result, projections aligned in conformity with the metal pin 4.8 form over the entire area of the circumference of the opening 11, said projections having critical influence on the pressure ratios in the opening 11 from the front 13.8 to the rear 12.8. In the presented case the projections 37.81, 37.82 arranged in circumferential direction to each other at equal distance are produced. The glass plug 6.8 can be here as a pressed piece.

[0046] Figure 9 illustrates an implementation in which the inner circumference 15.9 of the opening 11.9 is characterized by an essentially constant mean diameter d_1 and additionally for achieving the holding effect for the glass plug 6.9, either the inner circumference 15.9 of the opening 11.9 in the base plate 3.9 or the outer circumference of the glass plug 6.9 undergoes surface treatment, in particular a surface machining processing, such as e.g. sandblasting or staining. In the process roughness values in the area of $\mu \geq 10$ µm are achieved. The roughening of the surface serves the purpose of fit and supports the strength. In the implementation shown in Figure 9 preferably the entire inner circumference 15 of the opening 11.5 is subjected to a corresponding surface

treatment. Further the possibility exists to restrict the surface treatment to only a sub-area, whereby this should extend at least in the area of the rear 12.9.

[0047] In addition it would be possible to have the glass plug which is inserted into the base plate to be additionally enclosed by a socket. Then both the surface of the opening and/or the socket and/or the metal pin can be roughened.

[0048] Figure 10 illustrates a further alternative development. In this development the opening 11.10 is characterized by a greater diameter d_2 in the area of the rear 12.10 than on the front 13.10. This implementation makes it possible to design openings 11.10 also in thicker base plates 3.10. The opening 11.10 is for example punched or only bored out in sub-area 45. The second sub-area 46 is for example formed in both embodiments by boring this sub-area 46. In the bored sub-area 46 the glass plug 6.10 is inserted with the metal pin 4.10 and supported. Generally all of the possibilities named in the description for Figures 1 through 9 for inserting at least one opening in particular by means of punching out in a base plate are also suitable for inserting this opening in a first sub-area of the base plate and the rough working of the second sub-area for example by boring out of the base plate. The glass plug 6 with the metal pin can then be inserted into the first or second sub-area as described in Figures 1 through 9. While the previously described exemplified embodiments all referred to metal fixing material bushings, which comprised two metal pins, which were preferably in parallel arrangement, of which one of the metal pins was grounded to the rear of the base plate, the invention can in principle also be applied with more than two metal pins and with so-called mono pins. Mono pins are ignition units which comprise only a single metal pin, which is held by a pin support. The pin itself comprises for example a metal ring which forms the ground connection.

[0049] Such a mono pin is shown in Figure 11. The pin support 100 comprises a metal pin 103, which is embedded in an insulated panel 104, which is preferably made of glass. The pin support comprises a base plate 101.1, which recesses the metal pin 103 as well as a socket with an inner wall panel 101.1.2. The end of the sealed part of the metal pin 103 is electrically connected to the base plate 101.1 by means of a bridge 105. The opening 106 is placed in the base plate for example by means of a punching step. The opening can be placed in the base plate as previously described in Figures 1 through 10. Together with the opening the base plate 101.1 can be punched out as previously described. Preferably the opening is punched out together with the base plate. Especially preferably the base

plate forms a one-piece component with the socket 101.2. The manufacturing of a one-piece component can for example happen by having a punch part punched out in one procedure step and the socket can be obtained by means of deep drawing.

[0050] Preferably the inner wall panel of the socket as well as the free end of the metal pin 103 is coated. Gold for example is used as a coating material. Preferably the coating is applied using electrolytic procedures. The coating serves the purpose of keeping the electrical resistance at the junction point 108 between a plug 120, which is inserted into the socket and of the interior 101.1.2 of the socket 101.2 low. The plug is designated as 120 in the figure.

[0051] In the case of all of the implementations presented in Figures 1 through 10 the base plate 3 executed as a swivel part in implementations as per the state of the art is replaced by stamped metal parts. The individual measures for prevention of a withdrawal of the metal pin 4 from the base plate under stress, which were provided in the individual figures on base plate 3 and for prevention of the withdrawal of the metal pin from the fixing material on the metal pin can also be used with each other in combination. In this regard the implementation is not subject to any restrictions at all. However, those implementations are aimed at that guarantee a high strength of the overall connection between the metal pin 4 and the base plate 3 and thus the metal fixing material bushing 1.

[0052] With all of the implementations presented in the figures the openings can be formed with variable cross section. Preferably however circular cross sections are selected. The formation of the undercuts takes place as an integral component of the base plate.